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Device and Method for High-Sensitivity
Resolution Detection

Patent Claims

1. Device for high-sensitivity resolution detection of an external variable with a substrate, of
 - At least one generating device (4, 104) on the substrate for generating acoustic surface waves by application of an input frequency,
 - At least one active surface (10, 110) that can be covered with acoustic surface waves by means of at least one generating device (4, 104) for interaction with an external variable,

- At least one receiving device (6, 106) on the substrate to receive the surface waves after their passage through the active surface (10, 110),
 - Where the at least one generating device (4, 104) designed in such manner that the propagation range of the surface waves in question (1, 101) within the respective active surface (1, 110) changes with the height of the input frequency.
2. Device for high-sensitivity resolution detection of an external variable according to claim 1, in which the external variable includes a local magnetic range, local illumination (9, 11), local heating, and/or local mechanical stress of the substrate.
 3. Device for high-sensitivity resolution detection of an external variable according to claim 1, in which at least one portion of the substrate is functionalized in such manner that it is able to react chemically or physically with external reagents in the form of a mass-induced overlay.
 4. Device for high-sensitivity resolution detection of an external variable according to one of claims 1 to 3, in which the variable reacting with the acoustic surface waves (1, 101) is transmitted through local stresses in at least one portion of the substrate.
 5. Device for high-sensitivity resolution detection of an external variable according to one of claims 1 to 4, in which at least one generating device (4, 104) includes a surface wave transducer in which the position of the surface wave beam input changes with the stored high-frequency signal along its axis.

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6. Device for high-sensitivity resolution detection of an external variable according to claim 5, in which the surface wave transducer for generating an acoustic surface wave (1, 101) includes a tapped interdigital transducer (3) in which the frequency-determining finger interval (8) is not constant along the axis of the surface wave transducer.
7. Device for high-sensitivity resolution detection of an external variable according to claim 6, in which at least one receiving device (6, 106) has a second surface wave transducer designed as a tapped interdigital transducer (13), in which the frequency-determining interval is not constant along the axis of the surface wave transducer.
8. Device for high-sensitivity resolution detection of an external variable according to one of claims 1 to 7, with at least two generating devices (4, 104) for generating acoustic surface waves (1, 101), in which the respective active surfaces (10, 110) at least partially overlap, and at least two generating devices (4, 104) positioned in such manner that they can cover the overlapping area with surface waves from different directions and
- At least receiving two devices (6, 106) on the substrate for receiving the respective surface waves after their passage through the respective active surfaces (10, 110).
9. Device for high-sensitivity resolution detection of an external variable according to claim 8 insofar as it is dependent on claim 7, in which the variable areas of the

respective locally-changing frequency-determining finger intervals (8) of at least two generating devices do not have common values.

10. Device for high-sensitivity resolution detection of an external variable according to one of claims 1 to 9 with a radio-receiving device for receiving a radio frequency for frequency-dependent input into at least one generating device (4, 104) and a second device for emitting a frequency signal dependent on the signal received from the receiving device (6, 106) for receiving the surface waves (1, 101) after their passage through the active surface (10, 110),
in such manner that the device can be radio-scanned.
11. Device for high-sensitivity resolution detection of an external variable according to claim 10 with coding components for identifying the radio-scannable device.
12. Spectrometer arrangement with a component for wavelength-dependent deflection of a light beam and a device for high-sensitivity resolution detection according to one of claims 1 to 11 for detection of the light-beam deflection direction.
13. Imaging device with
a device according to one of claims 1 to 11, and
- an evaluation device for converting the output signal of the device into an image of the active surface (10, 110) under the influence of the external variable by means of image processing methods.
14. Method for high-sensitivity resolution detection of an external variable, in which

- acoustic surface waves (1, 101) are sent in at least one direction through an active area (10, 110) of a substrate and are detected, whereupon surface waves of various frequencies pass through other areas of the active surface (10, 110),
 - at least one part of the active surface (10, 110) is caused to interact locally with the external variable, and
 - a change of parameters of the surface waves (1, 101) is detected through this interaction.
15. Method for high-sensitivity resolution detection of an external variable according to claim 14, in which the external variable includes a local magnetic range, a local illumination (9, 11) of the substrate, a local mechanical stress of the substrate, and/or a local heating of the substrate.
16. Method for high-sensitivity resolution detection of an external variable according to claim 14, in which at least one portion of the substrate is functionalized in such manner that it is able to react chemically or physically with external reagents and the external variable has a mass-induced overlay.
17. Method for high-sensitivity resolution detection of an external variable according to one of claims 14 to 16, in which the external variable is transmitted by means of local stresses in the substrate.

18. Method for high-sensitivity resolution detection of an external variable according to one of claims 14 to 17, in which the surface-wave (1, 101) phase altered by interaction with the external variable is evaluated by the frequency in each case.
19. Method for high-sensitivity resolution detection of an external variable according to one of claims 14 to 18, in which the change in intensity of the surface wave through the interaction with the external variable at the frequency in each case is evaluated.
20. Method for high-sensitivity resolution detection of an external variable according to one of claims 14 to 19, in which the change in the lag time of the surface wave (1, 101) through the interaction with the external variable at the frequency in each case is evaluated.
21. Method for high-sensitivity resolution detection of an external variable according to one of claims 14 to 20, in which the input frequency during a measuring cycle is changed in such manner that the active surface (10, 110) of the substrate is covered through the change in input frequency.
22. Method according to one of claims 14 to 21, in which surface waves (1, 101) from a variety of directions are passed through the active area (10, 110).
23. Method for high-sensitivity resolution detection of an external variable according to claim 22, in which the frequency ranges of the surface waves (1, 101) coming from various direction do not have the same frequency at any time.

24. Method for high-sensitivity resolution detection of an external variable according to one of claims 22 or 23, in which the measured signals are evaluated with tomographic image processing methods.
25. Method for high-sensitivity resolution detection of an external variable according to one of claims 14 to 24, in which the acoustic surface waves (1, 101) are generated through beaming of a radio frequency into an antenna connected with at least one generating device (4, 104) for generating the acoustic surface (1, 101), and

the acoustic surface waves (1, 101) are received by a receiving device (6, 106) which includes a transmitter that emits a frequency signal,

so that the high-sensitivity resolution detection can be scanned wirelessly.
26. Method for high-sensitivity resolution detection of an external variable according to claim 25, in which in addition an identification coding is transmitted wirelessly.
27. Method for high-sensitivity resolution detection of an external variable according to one of claims 14 to 26, with a device according to one of claims 1 to 11.